MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2017/2018**

## BEC2044 – ECONOMETRICS I

( All sections / Groups )

16 OCTOBER 2017
2.30 p.m. – 4.30 p.m.
( 2 Hours )

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**INSTRUCTIONS TO STUDENTS**

1. This question paper consists of **FOUR (4)** questions in **FOUR (4)** printed pages, including formula sheet and statistical tables.

2. Answer **ALL** questions in the answer booklet provided.

3. Marks are shown at the end of each question.

## Question 1

(a) Explain the following terms:

(i) Sensitivity analysis (2 marks)

(ii) Redundant variable (2 marks)

(iii) Impure serial correlation (2 marks)

(iv) Pure heteroskedasticity (2 marks)

(b) Distinguish between:

(i) Best estimator and efficient estimator (4 marks)

(ii) Homoscedastic and heteroscedastic error term (4 marks)

(c) Briefly explain the **SIX (6)** steps in applied regression analysis with an example. (9 marks)

**[Total marks: 25 marks]**

## Question 2

Bowen and Finegan (1965) estimated the following regression equation for 78 cities (standard errors in paratheses):

$$\hat{L}_i = 94.2 - 0.24U_i + 0.20E_i - 0.69I_i - 0.061S_i + 0.002C_i - 0.80D_i \quad \text{Equation (1)}$$
$$(0.08) \quad (0.06) \quad (0.16) \quad (0.18) \quad (0.03) \quad (0.53)$$
$$N = 78 \qquad \bar{R}^2 = 0.51$$

$L_i$ = labour force participation rate in the $i$th city (in percent)
$U_i$ = unemployment rate in the $i$th city (in percent)
$E_i$ = average earnings in the $i$th city (hundreds of dollars/year)
$I_i$ = average other income in the $i$th city (hundreds of dollars/year)
$S_i$ = average schooling completed in the $i$th city (years)
$C_i$ = labour force that is non-white in the $i$th city (percent)
$D_i$ = a dummy equal to 1 if the city is in the South, 0 otherwise

(a) Interpret the estimated coefficients of $S$ and $D$. (5 marks)

(b) Develop and test a two-sided hypothesis about the coefficient of $D$ at 5% significance level. (5 marks)

**Continued...**

(c) How likely is perfect collinearity in Equation (1)? Justify your answer. (5 marks)

(d) Suppose that you were told that the data for Equation (1) were old and that estimates on new data yielded a much different coefficient of the dummy variable. Explain the possibility of biased estimate(s) in Equation (1). (5 marks)

(e) "I know that these results are not BLUE (Best Linear Unbiased Estimates) because the estimated coefficient $S$ is wrong. It's negative when it should be positive!" Do you agree? Comment on this statement. (5 marks)

**[Total marks: 25 marks]**

## Question 3

An econometrician is hired by the Department of Health in the United States. to study the determinants of smoking behavior. Equation (2) is estimated using a cross-sectional model based on data for all 50 states in the U.S. (standard errors in parentheses):

$$\hat{C}_i = 100 - 9.0E_i + 1.0I_i - 0.04T_i - 3.0V_i + 1.5R_i \qquad \text{Equation (2)}$$
$$(3.0) \quad (1.0) \quad (0.04) \quad (1.0) \quad (0.5)$$
$$N = 50 \qquad \bar{R}^2 = 0.40$$

$C_i$ = number of cigarettes consumed per day per person in the *i*th state
$E_i$ = average years of education for persons over 21 in the *i*th state
$I_i$ = average income in the *i*th state (thousands of dollars)
$T_i$ = tax per package of cigarettes in the *i*th state (cents)
$V_i$ = number of video advertisements against smoking aired on the three major networks in the *i*th state
$R_i$ = number of radio advertisements against smoking aired on the five largest radio networks in the *i*th state

(a) Determine the effectiveness of anti-smoking advertising on television based on Equation (2). (*Hint: Use hypothesis testing at 5% significance level*) (5 marks)

(b) Determine the effectiveness of anti-smoking advertising on radio based on Equation (2). (*Hint: Use hypothesis testing at 5% significance level*) (5 marks)

(c) Explain the possibility of omitted variables and irrelevant variables in Equation (2). (5 marks)

**Continued...**

(d) The Doctor General decides that tax rates are irrelevant to cigarette smoking and orders the econometrician to drop the variable from Equation (2). Given the new results (standard errors in parentheses) in Equation (2a), discuss using **FOUR (4)** specification criteria to decide whether you agree with his conclusion.

$$\hat{C}_i = 101 - 9.1E_i + 1.0I_i - 3.5V_i + 1.6R_i \qquad \text{Equation (2a)}$$
$$(3.0) \quad (0.9) \quad (1.0) \quad (0.5)$$
$$N = 50 \qquad \bar{R}^2 = 0.40$$

(10 marks)

**[Total marks: 25 marks]**

## Question 4

(a) Briefly explain **TWO (2)** consequences, a method of detection and a remedy for each of the following econometric problems:

(i) Multicollinearity (5 marks)

(ii) Serial correlation (5 marks)

(iii) Heteroskedasticity (5 marks)

(b) Equation (3) presents the petroleum consumption function for 50 states in the U.S.

$$\hat{P}_i = 4101 + 0.16REG_i - 1885PRICE_i \qquad \text{Equation (3)}$$
$$\text{s.e.} \qquad (0.01) \qquad (750)$$
$$N = 50 \qquad \bar{R}^2 = 0.76$$

Assume the followings are the auxiliary equations obtained from Equation (3):

$$e_i^2 = \beta_0 + \beta_1 REG_i + \beta_2 PRICE_i \qquad \text{Equation (3a)}$$
$$N = 50 \qquad R^2 = 0.197$$

$$e_i^2 = \alpha_0 + \alpha_1 REG_i + \alpha_2 PRICE_i + \alpha_3 REG_i^2 + \alpha_4 PRICE_i^2 + \alpha_5 REG_i * PRICE_i + \mu_i$$
Equation (3b)
$$N = 50 \qquad R^2 = 0.85$$

Using Equation (3a) and (3b), perform both Breusch-Pagan test and White test to check the existence of heteroscedasticity. (*Hint: Use 5% significance level*)

(10 marks)

**[Total marks: 25 marks]**

**End of Questions**

**Formula Sheet**

$$\text{t - statistic} = \frac{\hat{\beta} - \beta}{\text{se}(\hat{\beta})}$$

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$

$$\bar{R}^2 = 1 - (1-R^2)\frac{n-1}{n-k}$$

$$d \approx 2(1-\hat{\rho})$$

**Statistical Tables**

**Appendix 1: t-Table**

| **Two tails** | **0.2** | **0.1** | **0.05** | **0.02** | **0.01** |
|---|---|---|---|---|---|
| **One tail** | **0.1** | **0.05** | **0.025** | **0.01** | **0.005** |
| *df* | | | | | |
| 10 | 1.37 | 1.81 | 2.23 | 2.76 | 3.17 |
| 20 | 1.33 | 1.72 | 2.09 | 2.53 | 2.84 |
| 30 | 1.31 | 1.70 | 2.04 | 2.46 | 2.75 |
| 40 | 1.30 | 1.68 | 2.02 | 2.42 | 2.70 |
| 50 | 1.30 | 1.68 | 2.01 | 2.40 | 2.68 |
| 60 | 1.30 | 1.67 | 2.00 | 2.39 | 2.66 |
| 75 | 1.29 | 1.67 | 1.99 | 2.38 | 2.64 |
| 100 | 1.29 | 1.66 | 1.98 | 2.36 | 2.63 |
| 120 | 1.29 | 1.66 | 1.98 | 2.36 | 2.62 |

**Appendix 2: The Chi-Square Distribution**

| **Degrees of freedom** | **Level of Significance** | | |
|---|---|---|---|
| | **10%** | **5%** | **1%** |
| 1 | 2.71 | 3.84 | 6.63 |
| 2 | 4.61 | 5.99 | 9.21 |
| 3 | 6.25 | 7.81 | 11.34 |
| 4 | 7.78 | 9.49 | 13.28 |
| 5 | 9.24 | 11.07 | 15.09 |

where ***degrees of freedom*** = number of slope coefficients.

**End of Paper**